

SPAWNING AND DEVELOPMENT OF *BEDEVA PAIVAE* (CROSSE, 1864)  
(GASTROPODA: MURICIDAE), COMPILED FROM NOTES AND  
OBSERVATIONS BY FLORENCE V. MURRAY AND G. PRESTEDGE

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SUMMARY

Development of *Bedevea paivae* is followed from laying of the egg capsules to emergence of the crawling young. Rearing was successfully continued until maturity. Observations are made on sexual dimorphism (smaller male), copulation and capsule laying.

PREFACE

The late Miss Florence V. Murray had among her notes on the spawning and development of various species of gastropods, a draft of a paper titled "The Life History of *Bedevea paivae*." This paper could have been published as drafted except that the time scale for hatching and development had been left blank, obviously to be filled in later from notes. Also, except for a photograph of a capsule and some rough sketches of early cell divisions the paper was not illustrated.

Mr. G. Prestedge observed the spawning of *Bedevea paivae* and followed the development of the eggs through to hatching, recording his observations both by photographs and notes.

The observations of these two independent workers have been combined in the following account.

INTRODUCTION

Miss Murray commenced her observations, when in July 1963, she found at South Melbourne beach several valves of *Katelysia rhytiphora* Lamy, 1937 and *Ostrea angasi* Sowerby, 1871 bearing egg capsules on their inner surfaces.

The young *Bedevea* hatched the first week in August and immediately began to devour each other and grow. For food, they were provided with spat of *Mytilus planulatus* Lamarck, 1819, found on *Caulerpa* sp., and other small juvenile bivalves.

Mr. Prestedge began his observations with the accidental collection of a mated female that deposited egg capsules on the glass of his marine aquarium. Miss Murray's notes include accounts of capsules, eggs, development, rearing, growth and spawning.

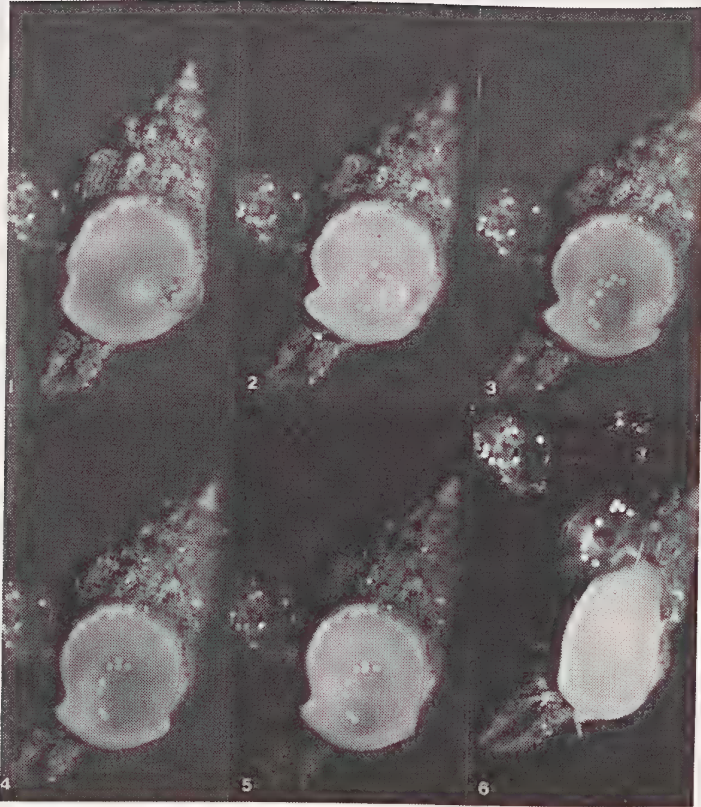


FIGURE 1-6.

This series of photographs illustrates the laying of an egg capsule by *Bedeva paivae*. The animal is viewed from the underside of the foot.

1. Capsule emerging through the genital aperture on the right of the foot. There is a completed capsule on the left of the photograph.
  2. Eight eggs are deposited in the capsule.
  3. The capsule is completed.
  4. The genital aperture is closing again.
  5. The foot resumes its normal shape.
  6. The animal moves off the capsule after the period of oscillation of the eggs.
- Photography G. Prestedge.

## SPAWNING

G. Prestedge observed the laying of two batches of spawn and described the method of laying of the second batch as follows:— *Bedeva* was in the position shown in the photograph (Fig. 1), the first capsule being on the right of the picture. At 1.42 p.m. a small indentation appeared in the foot, quickly followed by the first part of the emerging capsule (Fig. 1). Then came the eggs with equal rapidity, followed by the last part of the capsule. At the same time as the last part of the capsule was emerging, the indentation of the foot was disappearing, and the foot resumed its normal shape around the edge (Fig. 5).

There now followed a period when the eggs were oscillated to and fro in a semi-rotary fashion, the foot immediately over the capsule could be seen to be expanding and contracting at a fairly fast rate, as if the shaping of the capsule had to be completed before it became too hard to manipulate. This fast action was maintained till 1.55 p.m. Between 1.55 p.m. and 2.10 p.m. the rate of oscillation slowed down, from 2.10 p.m. to 2.15 p.m. it was very slow and after 2.15 p.m. ceased.

Between 2.15 p.m. and 6.02 p.m. the area of the foot immediately behind the centre of the capsule could be observed to give slight contractions from time to time. No regularity was noted in their occurrence. Also there was rippling along the front edge of the foot, and at times slight peaking of the front edge, as if *Bedeva* was preparing to move. The shell intermittently gave a slow twist clockwise, the extremities of the shell moving approximately 1 mm each time, then returning to its original position.

Between 6.02 p.m. and 6.10 p.m. *Bedeva* moved off the egg capsule, pausing for the last three minutes in the position shown (Fig. 6). It rotated its shell seven times anticlockwise through ninety degrees, returning to the vertical each time. There was no movement of the foot apart from a few slight contractions where it remained in contact with the capsule. It moved completely off the capsule at 6.25 p.m. and took up a horizontal position on the aquarium wall about 2 mm, above the capsule it had just laid. The foot now contracted to as small a size as possible, then expanded fully. This was repeated four times with varying degrees of contraction but always fully expanding, as if the area where the next capsule was to be laid was being cleaned. Shortly after this the laying of a third capsule commenced.

In all eleven capsules were laid between 29.9.75 and 6.10.75. The shell of the female measured 15 mm.

## CAPSULES

The capsule is lens-shaped, circular in outline, with a flattened base by which it is attached to the substratum, and a convex upper or free surface. The poriphery is edged with a narrow brim and in the middle of the convex face is a round exit hole, covered by a membrane and surrounded by a membrane and surrounded by a thick edge from which two sutures diverge. These run to the base of the capsule and divide it in half, (Fig. 7). The wall is semi-transparent so that the contents are visible. (Such capsules are laid by *Trophon* spp. (Lebour 1936; Thorson 1946).

*Size.* Average diameter 5.5 mm including the border which averages 0.65 mm in width. (Prestedge measurements, diameter 3-4 mm, depth 1 mm).

Exit hole, oval average size 1.0 mm × 0.85 mm.

Each capsule contains 6 to 16 eggs but usually 9 or 10. (Prestedge records capsules with from 4 to 12 eggs.)

## EGGS

Spherical, creamy and average 0.325 mm in diameter.

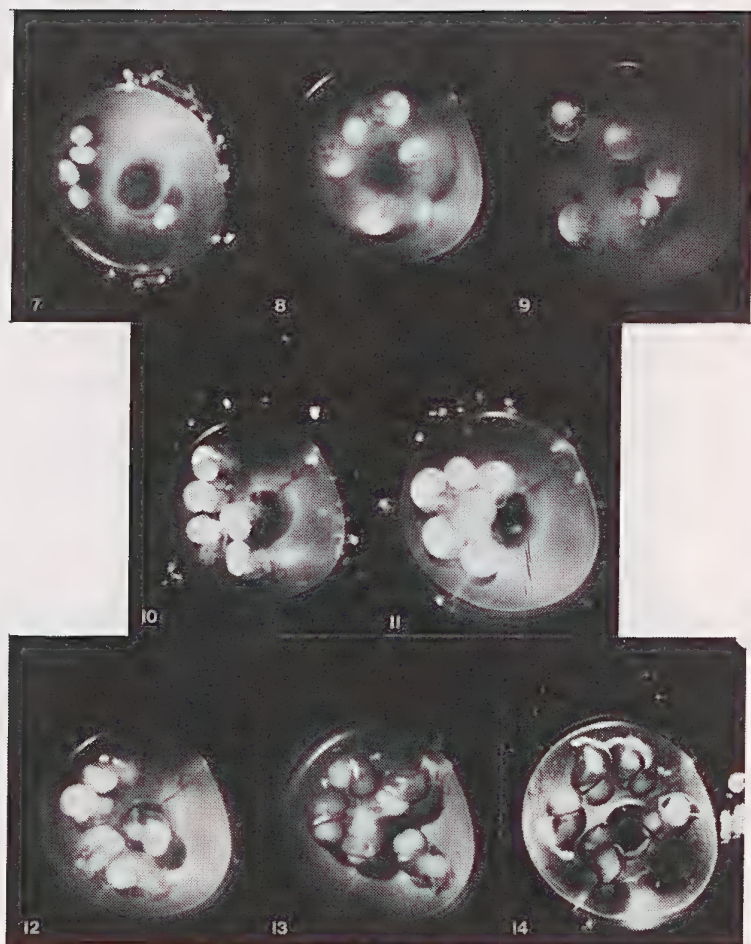
These are held securely within a viscous albuminous mass in the centre of the capsule and remain in the same position during the early stages of development. This albuminous mass is attached to the capsule wall by fine threads.

## DEVELOPMENT

Within 24 hours of deposition the egg developed a small prominence which soon divided off (Fig. 15, a) as a spherical polar body, 0.1 mm in diameter which floated in the plasma of the capsule before being absorbed.

The egg then divided into two equal cells (Fig. 15, c) which within three days divided somewhat unequally, resulting in two larger yolky megameres and two smaller micromeres (Fig. 15, e, f, g).





These united compactly together and a solid spherical blastula was apparent in five-six days. Small cells spread over the yolk cells and after about fourteen days outgrowths of the velum appeared (Fig. 7) at the sides of the mass.

As development proceeded the albumin became less viscous and less cloudy and the embryos were able to revolve and move about. The albumin mass appeared to shrink and the embryos to work their way to the outside and attach themselves to it by the stomadaeum (Fig. 10). If detached they soon became attached again until all the albumin was absorbed, when the now shelled veligers were more easily observed within the clear capsular fluid.

Pigmentation of the foot, velum and shell began to appear approximately six weeks after deposition of the capsule (Fig. 12).

When hatching was imminent the plug in the central exit hole gradually became thinner and drew away from the edges allowing the young to push through the thin outer covering (Fig. 14).

At the time of hatching the shell was a rich dark brown colour, about 1½ whorls, without sculpture but with growth lines parallel to the lip. Size varied from the smallest 1.0 x 0.700 mm to the largest 1.272 x 0.775 mm.

### REARING AND MATING

The juvenile *Bedeve* were fed on mussel spat which was attached to *Caulerpa* sp. After several months and the addition of a whorl to the shell they were large enough to feed on Venerid spat.

As they continued to grow it was noticeable that they fell into two size groups and this proved to be sexual dimorphism. In March, seven months after hatching the smaller specimens were noticed on the back of the lip of the larger females in a typical mating position and were observed in copulation.

At this stage three pairs were selected and isolated in separate jars for observation. The males, which averaged 9.5 mm in length continually haunted the females whose average size was 17 mm. They would remain in the mating position for 24 hours or more, or else rest on the backs or near their partners for days. Both would often feed on the same mussel.

In May, two months after the mating behaviour was noticed, the first egg capsules were deposited. At first only one or two capsules were spawned at a time, but later on more and more were laid at a session. Between laying periods the animals would feed and mate continually.

It was noticeable that the female would return to the same place to spawn, placing new capsules alongside those deposited previously. Spawning continued through to November and several isolated capsules were laid down as late as December.

During this period the animals made some growth and in December size and weights were;—females, 21 x 10 mm, 0.547 gms; males, 13 x 6 mm, 0.122 gms.

In the summer and autumn months the animals fed almost continuously (mussels and other bivalves notably *Notospisula parva*) and made shell growth. They began to deposit capsules again on 3rd April. Females now measured 22 x 11 mm, males 15 x 7 mm. As in the previous year the animals mated, spawned, fed and grew.

The capsules deposited during this second season were slightly larger than those deposited in the first season, also the average number of eggs increased and up to sixteen were frequently present in a capsule.

#### FIGURE 7-14.

This series of photographs illustrate the development of the embryos from the early veliger stage to hatching as shelled crawling young. This development was recorded between October 3 and November 4 when the embryos hatched. The date the photograph was taken is recorded in brackets after each caption.

7. Embryos showing elongation and appearance of velar lobes. (3:10)
  8. Velar lobes well developed, shell formation beginning (8:10)
  9. Shell well developed, yolk diminishing slightly, velum still active. (10:10)
  10. Embryos cluster around albumin. (11:10)
  11. Velum still large, yolk smaller. (15:10)
  12. Head process developing. Eyes prominent, Velar lobes still large. Pigmentation of foot and velum apparent. (19:10)
  13. Velum still present but smaller, Head pigmented, foot larger. (27:10)
  14. Velum absorbed and body withdrawn into the shell. (1:11)
- Photography G. Prestedge.

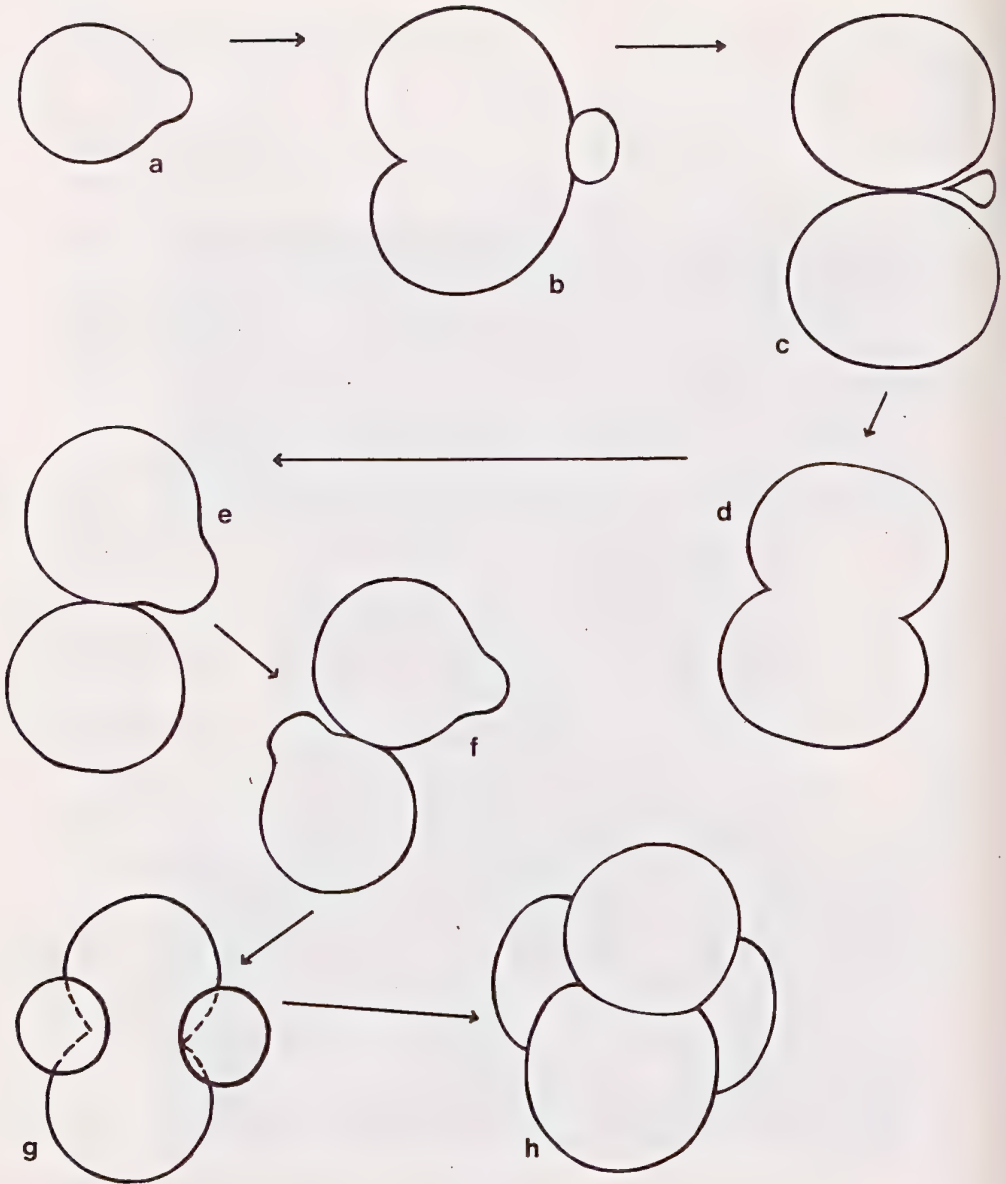


FIGURE 15.

Development of *Bedeva* egg during the first 48 hours. After F. V. Murray. (Times and dates in brackets.)

a. Polar body splits off. (5.30 p.m. 29. 8).

b. First appearance of division. (7.00 p.m. 29. 8).

c. Division (8.10 p.m. 29. 8).

d. The two cells appeared to have joined more closely together.

e&f Commencement of second division.

g. Formation of two larger megameres and two smaller micromeres. (11 a.m. 30. 8).

h. These became more compactly joined together. (1.). Further division produced a spherical ball — the solid blastula stage. (3.9—7.9).

## ACKNOWLEDGEMENTS

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